MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2019/2020

PPH0255 – PHYSICS

(Foundation in Information Technology)

3 March 2020
9.00 A.M – 11.00 A.M
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 4 printed pages with only 5 questions , excluding the cover page, physical constants, and formula list.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

LIST OF PHYSICAL CONSTANTS

Acceleration due to gravity	g	$9.80\ \text{m/s}^2$
Electron mass	m_e	$9.11 \times 10^{-31}\ \text{kg}$
Proton mass	m_p	$1.67 \times 10^{-27}\ \text{kg}$
Elementary Charge	e	$1.602 \times 10^{-19}\ \text{C}$
Coulomb Constant	k	$9.0 \times 10^{9}\ \text{N m}^2\text{. C}^{-2}$
Permittivity of free space	ε_0	$8.85 \times 10^{-12}\ \text{C}^2\text{N}^{-1}\text{.m}^{-2}$

LIST OF FORMULA

NEWTONIAN MECHANICS

$$\omega = \frac{\Delta\theta}{\Delta t} \qquad v = r\omega \qquad a = r\alpha$$

$$\omega = \omega_o + \alpha t \qquad \theta = \frac{1}{2}(\omega_0 + \omega)t \qquad \theta = \omega_0 t + \frac{1}{2}\alpha t^2$$

$$\omega^2 = \omega_0^2 + 2\alpha\theta \qquad \theta = \omega t - \frac{1}{2}\alpha t^2$$

$$W = Fs\cos\theta \qquad KE = \frac{1}{2}mv^2 \qquad PE_G = mgy$$

$$P = \frac{W}{t} = \frac{E}{t} = \frac{Fd}{t} = F\bar{v} \qquad p = mv \qquad \sum F = \frac{\Delta p}{\Delta t}$$

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2 \qquad m_1u_1 + m_2u_2 = (m_1 + m_2)\,v$$

ELECTRICITY

$q = Ne$

$F = k\frac{q_1 q_2}{r^2}$

$E = \frac{F}{q_o}$

$E = k\frac{q}{r^2}$

$\Phi = EA\cos\theta$

$\Phi_c = \frac{q_{in}}{\varepsilon_o}$

$V = \frac{U}{q_o}$

$V = \frac{kq}{r}$

$U = k\frac{q_1 q_2}{r_{12}}$

$C = \frac{\varepsilon_0 A}{d}$

$Q = CV$

$C = \kappa C_0$

$C_{eq} = C_1 + C_2 + \ldots.$

$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \ldots.$

$V = E\,d$

$U = ½\,QV$

$U = ½\,CV^2$

$U = \frac{Q^2}{2C}$

$u_E = ½\,\varepsilon_o E^2$

$I_{av} = \frac{\Delta Q}{\Delta t}$

$V = IR$

$R = \rho\frac{L}{A}$

$R_{eq} = R_1 + R_2 + \ldots$

$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$

$P = IV$

$P = I^2R$

$P = \frac{V^2}{R}$

$V = E - Ir$

STRUCTURED QUESTIONS [50 MARKS]

Instructions: Answer **ALL** questions in this section.

Question 1 [10 marks]

a. A carousel is initially at rest. At $t = 0$ it is given a constant acceleration $\alpha = 0.050$ rad/s^2, which increases its angular velocity for 10.0 s. Determine the following quantities at $t = 10.0$ s:

i. the angular velocity of the carousel. (1 mark)
ii. the linear velocity of a child located 2.5 m from the center. (1 mark)
iii. the the tangential (linear) acceleration of that child. (1 mark)
iv. the centripetal acceleration of the child. (1 mark)

b. A bicycle slows down uniformly from v_o = 8.0 m/s to rest over a distance of 110 m. Each wheel has an overall diameter of 65.0 cm. Calculate

i. the angular velocity of the wheel at the initial instant ($t = 0$) (1 mark)
ii. the total number of revolutions each wheel rotates (in radian) before coming to rest. (2 marks)
iii. the angular acceleration of the wheel. (2 marks)
iv. the time it takes to come to a stop. (1 mark)

Question 2 [10 marks]

a. A 1500 N crate rests on the floor. How much work is required to move it at constant speed

i. 4.0 m along the floor against a friction force of 230 N, and (1 mark)
ii. 4.0 m vertically. (1 mark)

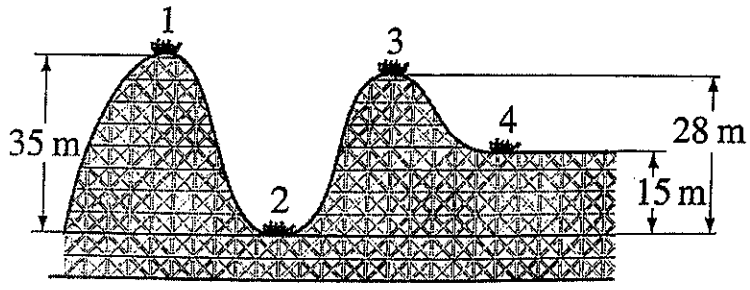

Figure Q2(b)

b. The roller-coaster car shown in **Figure Q2(b)** is dragged up to point **1** where it is released form rest. Assuming no friction, calculate the speeds at points **2** and **4**.

(4 marks)

Continued...

c. A 95 kg fullback is running at 4.0 m/s to the east and is stopped in 0.75 s by a head-on tackle by a tackler running due west. Calculate

i. the original momentum of the fullback. (1 mark)
ii. the impulse exerted on the fullback (1 mark)
iii. the impulse exerted on the tackler, and (1 mark)
iv. the average force exerted on the tackler. (1 mark)

Question 3 [10 marks]

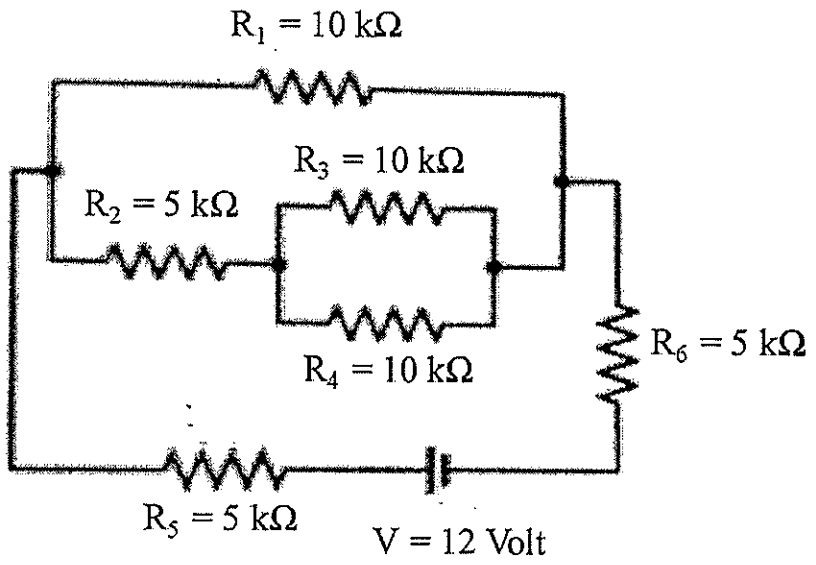

Figure Q3

A 12.0 Volt battery is connected in the circuit as shown in **Figure Q3**.

a. Calculate the equivalent resistance. (5 marks)
b. How much current is drawn from the battery? (1 mark)
c. What is the current flows through the R_2 resistor? (2 marks)
d. Determine the voltages across R_2 and R_5 resistors. (2 marks)

Continued...

Question 4 [10 marks]

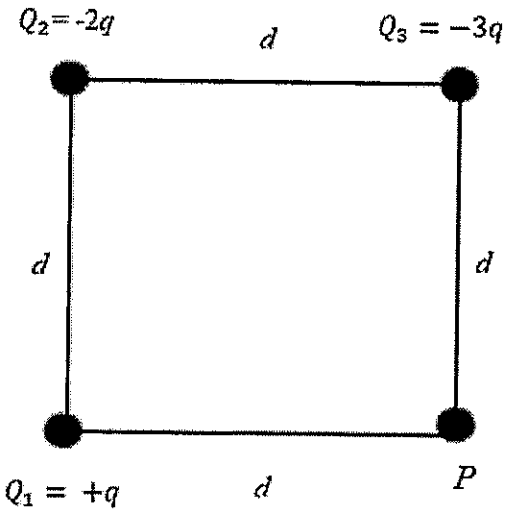

Figure Q4

Three point charges are located at the corners of a square with sides of length, $d = 20.0$ cm. (**Figure Q4**)

a. Find the direction and the magnitude of the net electrostatic field at point ***P***. Let $q = 2.0$ μC. (8 marks)

b. Determine the magnitude of the electric force exerted on the electron when the electron is placed at point ***P***. (2 marks)

Question 5 [10 marks]

a. Define the following terms:

i. Doping
ii. *p*-type semiconductor. (1 mark)

b. Explain how a pure semiconductor is changed to an *n*-type semiconductor. (4 marks)

Continued...

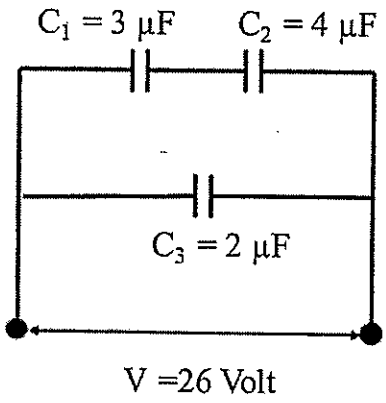

Figure Q5(c)

c. A 3.00 μF and a 4.00 μF capacitor are connected in series and this combination is connected in parallel with a 2.00 μF capacitor (**Figure Q5(c)**).

i. What is the net capacitance? (2 marks)

ii. If 26.0 V is applied across the whole network of **Figure Q5(c)**, calculate the voltage across the C_1 and C_2 capacitors. (3 marks)

End of Paper